## 6 | Autonomous AI Overview *(<=100 words) Provide a brief description of how your proposed autonomous AI would improve the process.*

The limitations of the current automated methods, including:

1) the difficulty to control with changing particle size distribution and hardness distribution of the incoming ore

2) it is a manual control and the operators take many years to master

3) the large performance discrepancy between novice and expert operators

Are strong indicators that we can teach and train a brain that can outperform the current methods.

We’ll train a brain that will control the gyratory crusher with two strategies that we have identified by talking with the subject matter experts.

## 7 | Optimization Goal *List and describe the key performance indicators that will define control/optimization of the system (Example: maximize (throughput)*

The goal is to maximize.

The KPI is throughput.

It is measured in tons / hour.

The throughput is the amount of material that passes through the crusher on to high pressure grinding rolls (HPGR) having met the 65mm fineness criteria for particle size.

## 8 | Autonomous AI Components *Select and explain the automation methods your AI will use.*

|  | **Method**  Check all that apply | **Description** |
| --- | --- | --- |
|  | Math (control systems) | We’ll continue using PID and MPC for low-level control of the system. |
|  | Menus (optimization) |  |
|  | Manuals  (expert rules and systems) |  |
|  | Machine learning | We might want to use a ML module with advance perception to predict the hardness of the incoming rocks. |
|  | Deep reinforcement learning | We have identified two strategies, which will be implemented with 2 DRL modules:   * When particle sizes are larger and /or ore is harder, choke the crusher (fill it up to the top) * When incoming particle sizes are smaller and / or ore is softer, regulate the crusher (fill it up to 2/3) |

## 9 | Autonomous AI Superpowers *Select the superpowers that your autonomous AI brain will exhibit and explain how they will lead to an improvement in the process.*

|  | **Superpower**  Check all that apply | **Description** |
| --- | --- | --- |
|  | Makes human-like decisions | The DRL modules that implement the two strategies will autonomously learn human-like decisions |
|  | Perceives, then acts | If we decide to add a Machine Learning algorithm to our brain design for advance perception, the brain will perceive and the chose the best action to take for each scenario |
|  | Learns and adapts | The Deep Reinforcement Learning modules will practice in simulator to learn the strategies, even in unlikely scenarios |
|  | Spots patterns | If we decide to use Machine Learning for advance perception, the brain will spot patterns and will be able to classify/predict the type of rock that is entering the crusher |
|  | Infers from experience | The DRL part of the brain practices in simulator, therefore it infers from that experience. |
|  | Improvises and strategizes | The DRL part of our brain will certainly learn strategy and it will adapt to rare situations because it would have already practice on those scenarios |